PROGRAM REVIEW 1985·86

NEWFOUNDLAND FORESTRY CENTRE

Government of Canada
Canadian Forestry Service

Gouvernement du Canada
Service canadien des forets

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1985-86
Newfoundland Forestry Centre
Canadian Forestry Service
Government of Canada

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THE CANADIAN FORESTRY SERVICE
GOVERNMENT OF CANADA

The Canadian Forestry Service is the principal source of federal expertise in forestry. Its general objective is to promote the wise management and use of Canada's forest resources for the economic, social and environmental benefit of Canadians.

The following are the main functions of the CFS:

1. Coordination of federal policies, for the promotion of better resource management and forest industry development.

2. Provision of scientific and technological leadership in forestry through research and development.

3. Provision and analysis of national and international statistics and information as a basis for policy formulation.

4. Development and certification of codes and standards for wood product performance.

5. Protection of Canada's forests from foreign pests.

6. Fostering the potential use of the forest resource for energy.

7. Contributing to the environmental objectives of the government of Canada.

A number of federal agencies are involved in forestry programs and a Federal Forestry Sector Strategy Committee has been established to coordinate federal forestry activities. The Canadian Forestry Service has been designated the lead agency.

The Canadian Forestry Service is comprised of a headquarters unit, six forestry centres, and two national institutes. The forestry centres are responsive to regional priorities and maintain close liaison with the respective provincial government forestry departments and other clients. They also participate in, and frequently lead,national programs. The national institutes provide the focus for programs of national scope.

SERVICE CANADIEN DES FORÊTS
GOUVERNEMENT DU CANADA

Le Service canadien des forêt (SCF) réunit la majorité des spécialistes fédéraux en foresterie. Son objectif général est de promouvoir l'aménagement et l'utilisation judicieux des resources forestières du Canada pour le plus grand bien économique, social et environnemental des Canadiens.

Voici les principales fonctions du SCF:

1. Coordonner les politiques fédérales afin de favoriser l'amélioration de la gestion des ressources et l'expansion de l'industrie forestière.

2. Fournir une orientation scientifique et technologique dans le domaine de la foresterie, par la recherche et le développement.

3. Fournir et analyser les statistiques et l'information nationales et internationales qui serviront à établir les politiques.

4. Mettre au point et homologuer des codes et des normes en matière de rendement des produits de bois.

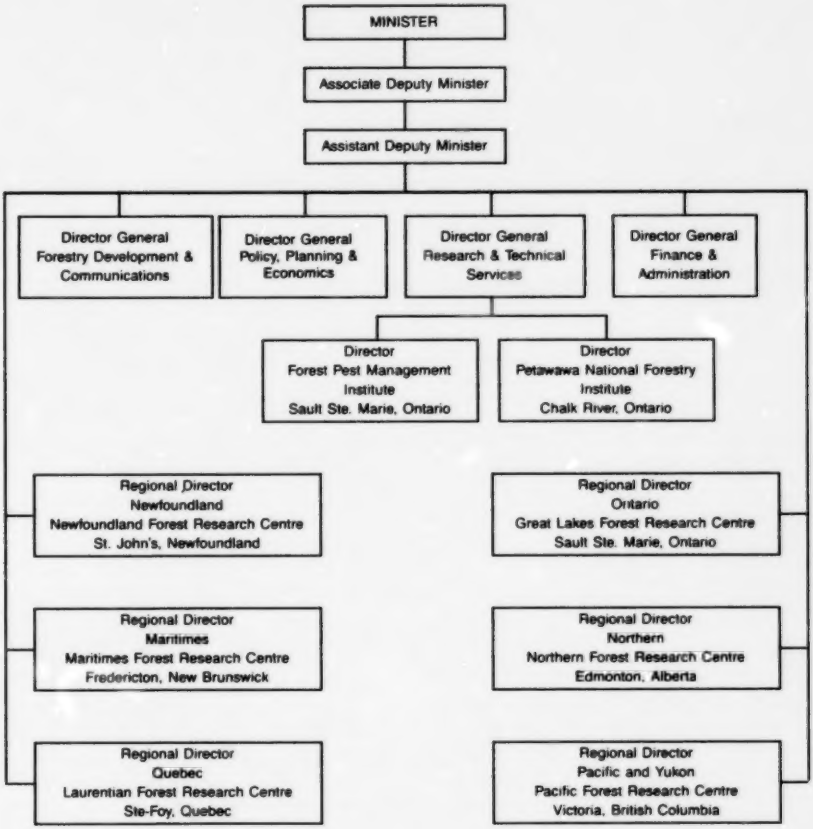
5. Protéger les forêts canadiennes en luttant contre les ravageurs étrangers.

6. Parrainer l'utilisation éventuelle des ressources forestières pour la production d'énergie.

7. Adhérer aux objectifs environnementaux du gouvernement fédéral.

Divers organismes fédéraux participent aux programmes forestiers, et un comité de la stratégie forestière fédérale a été créé pour coordonner les activités fédérales en matière de foresterie. Le SCF a été désigné organisme directeur.

Le Service canadien des forêts comprend une administration centrale, six centres de foresterie et deux instituts nationaux. Les centres de foresterie doivent répondre aux impératifs régionaux et entretenir une liaison étroite avec les ministères provinciaux des Forêts. Ils participent également à des programmes nationaux dont ils assument fréquemment la direction. Les instituts nationaux sont les foyers des programmes d'envergure nationale.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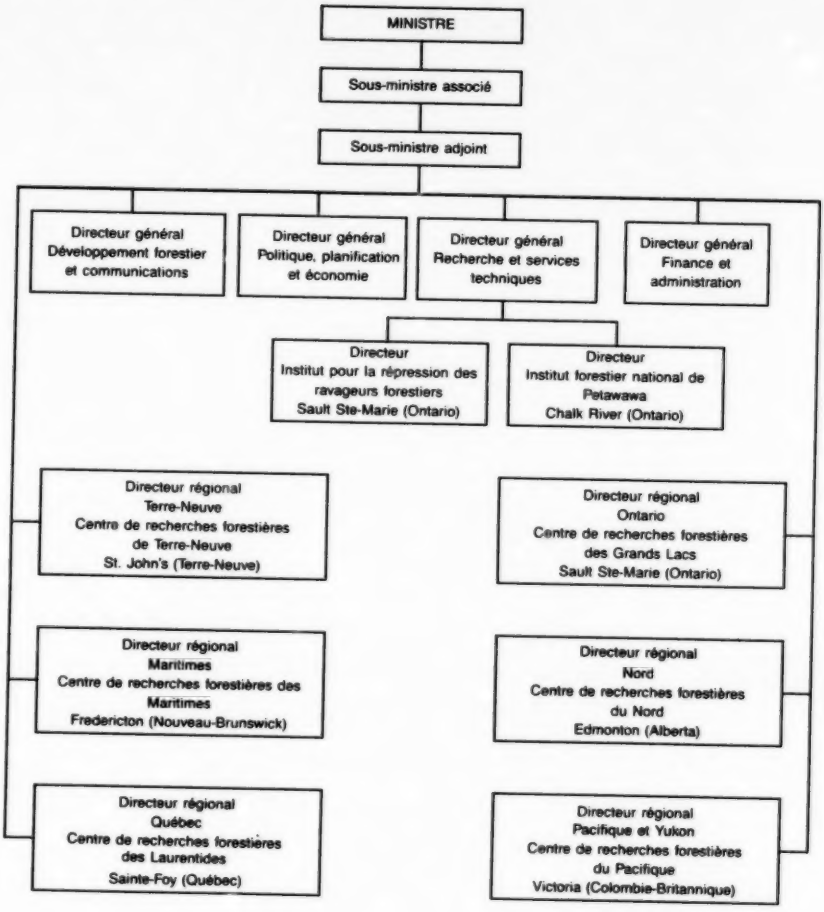
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J.A. Munro
Director General

FOREWORD

This program review of the Newfoundland Forestry Centre (NeFC) covers the period April 1985 to March 1986. The various research projects and studies conducted during the year are listed, the achievements are described and lists of publications and related productivity are provided.

The Newfoundland Forestry Centre is an establishment of the Canadian Forestry Service and is one of six similar regional establishments in Canada. The Centre conducts most of the forestry research in the Newfoundland and Labrador Region and also has the federal responsibility specific to forestry agreements between Canada and the Province.

The objective of the NeFC is to provide the scientific, technological and economic information and services required for the improvement, protection and efficient utilization of the forest resources of the province of Newfoundland and Labrador. The work is directed towards satisfying the requirements of the Provincial Government, the forest industry, federal agencies having forestry related problems and other clients of the Canadian Forestry Service. Many of its studies are undertaken jointly with client agencies. The Research Centre attempts to bring the results of research to potential users by publishing information reports, articles in scientific journals and by demonstrations of research results. It further seeks to keep the general public informed of its work by means of special displays, seminars and related activities.

During the fiscal year 1985-86, the annual budget for NeFC was approximately $4.3 million which included funding for salaries, operation and maintenance and capital expenditures for a full time staff of 74 person years. In addition to its headquarters buildings located in St. John's, the Centre also maintains a greenhouse complex in Mount Pearl and field stations at Badger and Pasadena in the central and western parts of the province.

The principal activities of the Centre are conducted under four areas of responsibility:

— Forest Resources and Environmental Research includes studies of soils, wetland and healthland ecology, reforestation, tree growth, forest genetics, and environmental forestry.
— The Centre's forest protection program conducts research on the development of pest management strategies and guidelines, on the biology of pest species and natural control factors. In addition it conducts forest insect and disease surveys to detect, to monitor and forecast geographic distribution and intensity and to assess damage.

— The Forestry Development branch is primarily responsible for activities associated with the federal-provincial forestry agreements and various job creation programs. It participates in the development, planning and implementation of agreements as well as providing economic analysis and evaluation of agreement activities.
— Technology Transfer and Public Information Services Unit coordinates and facilitates the technical information exchange activities conducted by the Centre. In addition, the unit is responsible for providing editorial, press relations and information to the general public.

J.A. Munro
Director General

Program Management

Project 1111
Program Management
Project Leader: J.A. Munro

Objectives: To ensure efficient planning and management of the research and development activities of NeFC; to ensure that NeFC activities are responsive to regional needs, priorities and concerns of the Government of Canada.

Achievements Current Year: Negotiations for a new Federal-Provincial Development Agreement were concluded in February 1986 and the appropriate documents prepared for consideration by the senior levels of government.

Goals for 1986-87: To continue to provide direction to the research and development programs conducted at this Centre. This will include a closer association with co-operating agencies through the Canada-Newfoundland Joint Forest Research Committee.

Finance and Administration

Projects 1211/1221
Financial and Administrative Services
Project Leader: R.J. Angel

Objectives: To provide consulting and advisory services to management ensuring internal control of finances and various research support facilities.

Achievements Current Year: As in previous years, a wide variety of financial services were provided at the Centre. Major renovations were made at the Badger Field Station to comply with the Federal Government Fire Commissioner's standards. Additionally, renovations were completed at the headquarters buildings to accommodate new staff.

Goals for 1986-87: To make more effective use of the AFMAS system which will provide a more detailed accounting service at the project and study levels. A new coding structure will be implemented providing more detailed information on the joint Canada-Newfoundland Forestry Agreement. Records and Material Management will be computerized and the existing financial computerized system will be interfaced with a VAX computer.

Program Management and Support

Project 2111
Program Management
Project Leaders: A.B. Case and J. Hudak

Objectives: To ensure effective management of personnel and financial resources allocated to research programs and to maintain scientific and technology transfer elements of programs at a high level.

Achievements Current Year: Research in reforestation and growth and yield were expanded to include additional studies and initiatives. Two major site classification workshops were held in central and western Newfoundland and a new study on **Kalmia** was introduced under a Post-Doctoral Fellow. Ongoing support was provided to various cooperative working groups and 82 publications and contributions to seminars, symposia and conferences pertaining to forest resources and environmental research were produced or presented.
The Forest Protection Program continued to improve its capability to detect and forecast major forest pests while research on cone and seed pests, impact of spruce budworm and the effect of subsequent secondary pests continued. A major effort was expanded in testing the effectiveness of several pest control products against the eastern hemlock looper.
Biological control research on forest pests resulted in the introduction of selected parasites and disease organisms as well as the testing of the effect of a locally isolated nematode against the hemlock looper. The results of forest protection research were disseminated through a number of workshops and seminars and a total of 71 papers and reports being produced.

Goals for 1986-87: To develop (as part of a five-year operating plan) new project direction and studies in forest production and environmental forestry. To emphasize research activities on spruce budworm, hemlock looper, balsam woolly aphid and on pests associated with seeds, cones and forest improvement areas.

A.B. CASE — PROGRAM DIRECTOR

Forest Resource and Environmental Research

Project 2211
Environmental Assessment of Forestry Practices
Project Leader: I.D. Thompson
(Joined staff December, 1985)

Objectives: To assess impacts of forest management practices on terrestrial and aquatic systems. To assess the effects of wildlife on forest succession and to characterize moose habitat requirements in relation to forest management planning. To develop a predictive capacity with respect to environmental impacts of harvesting and silvicultural practices. To develop guidelines for environmentally sound forestry. To provide advice to resource and environmental agencies at both the federal and provincial levels.

Achievements Current Year: A method for mapping land sensitivity to harvesting was developed and new project directions to examine forestry-wildlife interactions were established.

Goals for 1986-87: To commence a study on the requirements and value of buffer strips for water quality and wildlife protection with the goal of developing guidelines for buffer strips in relation to forestry operations near aquatic areas. To begin research into the effects of moose as agents of altered successional trends; and to further develop the existing forest land sensitivity study.

List of Studies

4202 — Services to the Federal Environment Assessment and Review Office (FEARO), Regional Screening Coordinating Committee (RSCC) and environmental agencies.

4203 — Guideline development for buffer strips.
Leader — I.D. Thompson

4204 — Improved multiple use forestry related to wildlife.
Leader — I.D. Thompson

4205 — Effects of moose on forest regeneration.
Leader — I.D. Thompson

4206 — Sensitivity of land to forest practices.
Leader — A.R. van Kesteren

Project 2214
Forest and Plant Ecology
Project Leader: W.J. Meades

Objectives: To determine the ecological relationships among major vegetation types of Newfoundland and Labrador and their natural environments; to provide a general system of site classification for forest and wildland habitats in Newfoundland and Labrador to assist resource managers in determining priority utilization for various resource development scenarios; to develop means of predicting and assessing gross successional changes in vegetation due to natural or human disturbances; to determine the forest productive capacity of wetlands; to generate soils information in support of forest growth and productivity studies; to apply the data bank generated from such studies to forest and other land management problems; to provide national and international leadership and technology transfer in the development of ecological land classification systems.

Achievements Current Year: A peatland forestry site was established near Badger, Newfoundland including four drainage intensities, two fertilization treatments, two surface treatments and two species (eastern larch and black spruce) and two site types (bog and fen). A chapter on the wetlands of eastern Canada was submitted for inclusion in a book on the "Wetlands of Canada". Site classification workshops were held in central and western Newfoundland which included a series of lectures supported by field trips. A new study was initiated on the allelopathic relationships between *Kalmia angustifolia* and black spruce. Background information on the location, age and disturbance history of burnt and cut forest lands in western Newfoundland were compiled to initiate a study on site classification of disturbed forest lands. A paper on the distribution and extent of red pine was published in Rhodora. An information report on an excavation technique for sampling soil columns was published. Contributions were made to six major meetings and workshops.

Goals for 1986-87: To continue monitoring the peatland afforestation experiment and initiate supplementary fertilization trials and foliage analysis on older peatland plantations. To initiate field studies of classification and succession on cut and burnt forest lands. To participate in a joint study with the Department of Forest Resources and Lands on control of *Kalmia* on black spruce cutovers in central Newfoundland. To continue greenhouse experiments on allelopathic interaction between *Kalmia* and black spruce and publish preliminary results. To initiate field studies on the autecology of white spruce. To

complete two papers for submission to journals and three for inclusion in books.
To characterize seepage soils on central Newfoundland sites.

List of Studies
Ecological investigation of wetlands for forestry.

Leader — E.D. Wells
Ecological investigations of heathlands.
Leader — W.J. Meades (A. Mallik - visiting fellow)
Forest classification, ecology and mapping.
Leader — W.J. Meades, A.R. van Kesteren
Autecological studies of major trees, shrubs and related vegetation.
Leader — B.A. Roberts
Ecology of Newfoundland soils.
Leader — B.A. Roberts

Project 2221
Tree Seed and Improvement Research
Project Leader: J.P. Hall

Objectives: To evaluate through species and provenance testing, breeding and selection the productive potential of various native and exotic tree species suitable for reforestation in Newfoundland; to develop technical assistance and services to provincial government and industry in Newfoundland and to outside agencies; to ensure that research findings are translated into economic and environmental gains by transfer to resource agencies.

Achievements Current Year: *Native species* — Preliminary results of a study on artificial induction of flowering on black spruce were published and a method for selecting for growth rate and specific gravity of black spruce continued. Work continued on a white spruce provenance trial (25 years from seed) and several superior provenances from Quebec and Ottawa were identified as suitable for use in Newfoundland. *Exotic species* — Measurements of the exotic Sitka spruce provenance trials were completed and analyzed. Introgressed red spruce were shown to have grown faster than pure red spruce.

Goals for 1986-87: Publications on the various provenance trials of native species will be prepared, while controlled pollinations in white spruce and larch will be continued. A provenance plantation of *Larix decidua* will be established, species trials (age 20) will be remeasured and the introduction of exotics will continue.

List of Studies

Genetic improvement of native conifers.
Leader — J.P. Hall
Genetic improvement of exotic species in Newfoundland.
Leader — J.P. Hall
Advisory services to the Tree Improvement Working Group.
Leader — J.P. Hall

Project 2222

Reforestation
Project Leader: B.D. Titus

Objectives: To develop and demonstrate silvicultural techniques required to overcome site problems adversely affecting forest productivity on mineral soil sites; to determine techniques for improving forest productivity through intensive management involving silvicultural treatments and stand establishment.

Achievement Current Year: Surveys were conducted on two aerially seeded sites and additional plots established while data acquisition for a survey methodology study was completed. Older plantations on the North Pond demonstration area were re-established; remeasurements were done on both planting stock comparison trials and seedling quality trials; and a comprehensive site preparation study proposal was developed.

Goals for 1986-87: A new study on site preparation will be initiated and re-establishment work at North Pond will be continued; some older plantation studies will be concluded.

List of Studies

Competition control on forest sites.
Leader — J. Richardson
Influence of biometeorological factors on forest productivity.
Leader — A.W. Robertson
Survey methodology and seedling stocking density relationships in black spruce and black spruce-balsam fir populations.
Leader — P.F. Newton
Silvicultural workshops and demonstrations.
Leaders — J. Richardson, B.D. Titus, V.D. Chaffey
Plantation research.
Leaders — J. Richardson, B.D. Titus, V.D. Chaffey
Site preparation research.
Leader — B.D. Titus

Project 2223
Tree and Stand Growth
Project Leader: M.B. Lavigne

Objectives: To examine and assess the processes involved in tree growth and stand development as a basis for growth and yield prediction; to determine the effect on growth and yield of natural and man-caused perturbations and stand manipulation practices in relation to site, density and species composition; to interface with forest agencies to ensure effective transfer of research information and knowledge on data collection, tree and stand development and yield prediction.

Achievements Current Year: Foliage samples were collected for nutrient analyses from three pre-commercial thinning trials and work continued on the tree stand growth model for black spruce. Additionally a Ph.D. dissertation based on analysis of respiration and growth rates of young balsam fir in natural stands was completed.

Goals for 1986-87: Two established spacing trials will be remeasured and growth data from spacing projects carried out by the Newfoundland Department of Forest Resources and Lands and the two pulp and paper companies will be collected. Soil and foliage samples will be collected from various established trials and analyzed. A new planted spacing experiment will be established and work will continue on growth and yield modelling in black spruce and on production processed in balsam fir stands.

List of Studies

Influence on stand density and fertilization on productivity of natural and planted softwoods.
Leaders — M.B. Lavigne, R.S. van Nostrand
Quantitative site assessment on recently disturbed areas - STUDY CLOSED.
Production process in balsam fir stands.
Leader — M.B. Lavigne
Development of a stand density management model for pure black spruce forest types within central insular Newfoundland.
Leader — P.F. Newton
Advisory services to forest agencies.
Leader — M.B. Lavigne

Project 2241
ENFOR (ENergy from the FORest)
Project Leader: R.S. van Nostrand

Objectives: To determine the feasibility of using forest biomass for energy production in Newfoundland; to assist the Department of Forest Resources and Lands in developing long term strategies for the utilization of biomass for energy; to cooperate with the Department of Forest Resources and Lands in developing methods and techniques for biomass inventory and management; to assess environmental impacts of biomass harvesting and methods of reforestation.

Achievements Current Year: The *Salix* energy plantation work continued and replicated experiments to test clone production were established on four test sites in central and western Newfoundland. A sophisticated energy balance measuring system was fabricated and tested at the Pasadena Field Station Nursery. An experiment to study the correlation between diurnal growth patterns and climatic variables was completed. A study of insects affecting *Salix* biomass production was completed. Field and laboratory work necessary to complete the calibration of the FORCYTE II growth model for selected balsam fir sites in western Newfoundland continued. The second planting of softwood seedlings on sites recently harvested for hardwood biomass fuel was completed. This trial compares seedling success rate with time of planting from harvest.

Goals for 1986-87: To infill and weed the *Salix* test blocks; to further test the energy balance system on a cleared productive forest site in central Newfoundland; to continue studies of correlations between growth patterns and climatic variables. To complete the collection and analyses of data necessary to calibrate the FORCYTE II growth model and conduct a test run. To record appropriate ecological data and complete the third planting of softwood seedings on a hardwood site harvested for fuel.

List of Studies

Reforestation after whole-tree chipping for hog fuel.
Leaders — R.S. van Nostrand, V.D. Chaffey
Boreal energy plantation R & D.
Leaders — A.W. Robertson, C.T. French
Calibrating the FORCYTE growth model for Newfoundland forest types.
Leader — W.J. Meades

J. Hudak - Program Director

Forest Protection Research

Project 2232
Pest Biology Research
Project Leader: A.G. Raske

Objectives: To develop effective and practical methods for measuring population levels of forest pests and their natural control factors; to investigate the biology of pest insects and diseases including their population dynamics; to assess insect and disease impacts on major age classes of forest trees and stands; to develop methods to prevent or minimize forest losses.

Achievements Current Year: Germination tests of seeds from insect damaged cones and studies on seed losses caused by red squirrel predation were continued. A cooperative project with the Forest Pest Management Institute tested pheromones of the spruce coneworm and spruce seedworm in Newfoundland. Morphological changes in host tissues caused by midge attack were studied with paraffin embedded sections of buds. *Bacillus thuringiensis* was applied through aerial spraying against the white-marked tussock moth and the recent increase in balsam woolly aphid damage in western Newfoundland was inspected jointly by all forest agencies. Approximately 10,000 hemlock looper pupae were sent for extraction of the sex pheromone, which resulted in a series of compounds being isolated and tested. Studies on the determination of balsam fir damaged by the spruce budworm continued and results were written for a Ph.D. thesis. In addition black spruce was sampled for fungal pathogens responsible for its deterioration.
Equations, coefficients and tables for gross and net merchantable volumes were completed for each management unit, and for sawlog volumes for four regions. Data bases for wood density were updated. Spruce budworm larvae were collected at one locality to study population dynamics and natural control factors, and the parasite *Apanteles murinanae* from Europe were released for potential spruce budworm control. Software packages for growth-ring analysis were adapted for our purposes to assess the impact of defoliation on tree growth. The effectiveness of several insecticides were field tested against the hemlock looper.

Goals for 1986-87:
- To continue germination tests of seed from insect damaged cones and to continue studies of the biology, including pheromones, of seed pests.
- To continue studies on midge ecology and its chemical control with systemic insecticides.
- To examine the sampling system for the balsam woolly aphid and formulate plans for direct control experiments and for assessing impact on growth of thinned stands.
- To continue efforts to identify the sex pheromone of the hemlock looper (contract research).

— To report the investigation of the distribution and severity of *Armillaria* in the roots of balsam fir damaged by the spruce budworm in the same stands sampled in 1981.
— To continue studies of deterioration of black spruce and the associated microflora and insect activity.
— To investigate wood losses due to blowdown and subsequent deterioration in insect damaged stands, and to continue sampling utility poles for active decay.
— To continue analysis of the data base to identify site and stand variable for a natural stratification of cull regions in Newfoundland.
— To finalize studies on the impact of the four-eyed spruce bark beetle on damaged black spruce.
— To continue the process of identifying the pheromone of the four-eyed spruce bark beetle.
— To continue monitoring spruce budworm population and their natural control factors.
— To continue growth-ring analysis of budworm-damaged trees and establish plots to quantify impact of hemlock looper defoliation.
— To remeasure quantity of moose browse at permanent sample points.
— To remeasure permanent plots for determining changes in forest succession.
— To determine the fate of Dimilin in aquatic ecosystems and in soils (contract research).
— To test a new formulation of fenitrothion against the hemlock looper.
— To continue chemical analysis of black spruce tissue to determine assimilate partitioning in damaged black spruce (control research).

List of Studies

Factors damaging to cone crops.
Leader — R.J. West
Damage from balsam woolly aphid.
Leader — E.J. Dobesberger
Sex pheromone(s) of the eastern hemlock looper.
Leader — K.P. Lim
Armillaria root rot.
Leader — Vacant
Deterioration of insect damaged trees.
Leader — G.R. Warren
Decay and wood quality of living trees.
Leader — G.R. Warren
Role of woodborers and bark beetles in tree mortality and deterioration.
Leader — W.W. Bowers
Population studies of major defoliators.
Leader — E.J. Dobesberger
Biocontrol factors of major defoliators.
Leader — K.P. Lim
Impact of major defoliators.
Leaders — A.G. Raske and E.J. Dobesberger
Impact of spruce budworm on forest succession.
Leader — W.J. Meades
Plantation and regeneration insects.
Leader — R.J. West
Effectiveness of insecticides.
Leaders — A.G. Raske, R.J. West and K.P. Lim
Food storage compounds in relation to defoliation.
Leaders — A.G. Raske and M.B. Lavigne

Project 2234
Biological Control Research
Project Leader: K.P. Lim

Objectives: To develop effective biological control of forest pests; to evaluate the effect of chemical insecticide(s) on biological control agents of forest pests; to investigate the potential use of entomogenous nematodes as biological control agents of forest pests.

Achievements Current Year: *European pine sawfly* — A nuclear polyhedrosis was applied against the newly hatched larvae at St. John's and Mount Pearl. *Mountain-ash sawfly* — Larvae of the introduced parasite, *Olesicampe geniculatae*, were recovered from dissection of host larvae collected from Oxen Pond Botanic Park. *Hemlock looper* — About 0.5% of the larval samples and 1.5% of the pupal samples were parasitized. *Entomogenous nematode* — Two species of nematodes isolated from local soil samples were tested against the hemlock looper. Insecticide spray was applied on the parasites of the hemlock looper to determine effects. *Birch casebearer* — The parasite, *Apanteles coleophorae* released near Gambo in 1975, was recovered for the first time.

Goals for 1986-87: More emphasis will be placed on aspects of life history of parasitoid insects and host parasitoid interactions. Larval parasites of the mountain-ash sawfly will be monitored for dispersal. The effectiveness of the introduced tachinid, *W. occidentalis*, on the hemlock looper will be monitored. Scientific authority on research contracts on entomogenous nematodes will be provided.

List of Studies

Populations of biological control agents.
Leader — K.P. Lim
Control of forest insect pests with nematodes.
Leader — K.P. Lim
Effect of insecticides on parasites of hemlock looper.
Leader — K.P. Lim

Project 2311
FIDS (Forest Insect and Disease Survey)
Chief Ranger: L.J. Clarke

Objectives: To conduct annual surveys of forest pest conditions, determine the extent of infestations, assess the impact, forecast impending conditions, and recommend control measures and when necessary evaluate the effectiveness of direct control measures. To provide forest pest data and related information for the National Forest Resource Data Program of Canada and other national and regional reports.

Achievements Current Year: The annual general detection, monitoring, appraisal and forecast of forest insects and diseases were completed. The data analyzed and interpreted, and presented to forest resource managers in the form of publications, reports and at special seminars and meetings. With this data, resource managers evaluated the problems, planned and conducted the necessary control action. Information on many forest pests was provided, including details of the three major pests of the year; the hemlock looper, the spruce budworm, and the balsam woolly aphid. Defoliation by the hemlock looper was recorded on about 131 000 ha. In addition, the egg survey method was improved and forecasts made. Thirty permanent sample sites were located for annual monitoring of spruce budworm populations with sex pheromone traps. Assessment of budworm caused tree mortality became the responsibility of the Provincial Department of Forest Resources and Lands, and there was no direct participation by FIDS staff. Preliminary surveys for aphid populations and damage were completed in fall in recently thinned immature stands. Special pheromone trap surveys were conducted in cooperation with Agriculture Canada to monitor the possible introduction of the gypsy moth and forest tent caterpillars. A special survey was conducted in cooperation with Memorial University to determine the distribution of the pinewood nematode. Permanent sample plots established for the early detection of acid precipitation were monitored throughout central and eastern Newfoundland. FIDS staff assisted in testing the effectiveness of fenitrothion, matacil, *Bacillus thuringiensis* and dimilin against the eastern hemlock looper and in developing a sampling system for forecasting hemlock looper defoliation.

Goals for 1986-87: Continue surveys for detecting, appraising and forecasting forest pest conditions in general and with special emphasis on spruce budworm, hemlock looper, balsam woolly aphid, Scleroderris canker, and general pest conditions in forest improvement areas. Disseminate information to forest agen-

cies and the general public through written papers, reports, seminars, workshops and verbal communications Provide information on forest pests for inclusion in national publications.

List of Studies

Detection and forecasting forest pest conditions.
Leaders — L.J. Clarke and G.C. Carew

J.M. Butler, Program Director (Acting)

Forest Development

Project 3111
Program Management
Project Leader: J.M. Butler

Objectives: To provide management and common support services to the Forestry Development Branch at NeFC, to recruit and train appropriate staff to discharge the economic analysis and development responsibilities of the branch.

Achievements Current Year: During this period the Program Director, Development was appointed as the Regional Director General. The Senior Development Officer was subsequently appointed as Acting Program Director, Development in September. Staffing for two term positions — a secretary and a computer programmer — were successfully completed. In addition, an Environment 2000 Project Officer was appointed as the technical project officer for the forestry component of the EIC, Job Development Program. These positions provided necessary support for implementing various programs.

Goals for 1986-87: To continue to provide managerial and common support services for the Forest Relations and Economic Development Branch.

List of Studies
Not applicable.

Project 3251
Agreement Administration (CFS Resource)
Project Leader: J.M. Butler

Objectives: To discharge federal responsibilities for the implementation and evaluation of forestry agreements in Newfoundland; to facilitate the transfer of new technology into the forestry sector in Newfoundland and to implement forestry job creation programs as required.

Achievements Current Year: In 1985-86 the CFS was given the responsibility of technical monitoring of 10 forestry projects approved under the EIC Job Development Program. Forestry Development staff continued to play a major role in introducing and adapting new technology to Newfoundland, particularly in the areas of site preparation, equipment trials and biomass harvesting. Development staff also assessed, monitored and evaluated projects and programs approved under the Canada-Newfoundland Forest Subsidiary Agreement II (FSA II). The acting program director was a member of the federal team which successfully negotiated with the Province on a new cost shared Canada-Newfoundland Forest Development Agreement valued at $48 million.

Goals for 1986-87: To complete management and evaluation responsibilities associated with the Canada-Newfoundland Forest Subsidiary Agreement II. Implement a new cost-shared Forest Resource Development Agreement with the Province. Develop a forest management information system for the new agreement and assist in the transfer of technology from outside Newfoundland, particularly in the areas of silviculture, forest products development, access roads construction and forest inventory. Technical monitoring of forestry projects approved under the EIC Job Development Program will continue.

List of Studies

Agreement implementation.
Leader — J.M. Butler
Agreement technology transfer.
Leader — J.M. Butler
Agreement evaluations.
Leaders — D.L. Hayden and W.L. Alexander

Project 1333
Advice and Consultation Services
Project Leader: D.L. Hayden

Objectives: To provide economic advisory services to federal government departments, provincial authorities and industry for establishing sound forest resource development programs in Newfoundland and in the establishment of priorities for research and development activities of CFS.

Achievements Current Year: Economic advisory services were provided to the Provincial Department of Forest Resources and Lands, Department of Mines and Energy, Canadian Forestry Service, industry and other client agencies, as requested. Information releases were made through the regional newsletter and media interviews.

Goals for 1986-87: To continue to provide services on an "as required" basis.

Project 1334
Economic Studies
Project Leaders: G.R. Milne and D.L. Hayden

Objectives: To conduct applied research studies in forest economics directed toward specific resource and industry problems and opportunities in Newfoundland.

Achievements Current Year: A wide range of short-term studies were conducted in response to problems requiring immediate action. Several longer term studies were continued which address major forest resource and industry questions. A major statistics publication was published. A study on Newfoundland's newsprint exports were carried out.

Projections: Conduct short-term analyses in support of advisory and consultation services as required. Complete industry research through a study describing the economic importance of the entire Newfoundland forest industry. Continue a cost/benefit analysis of pre-commercial thinning operations. Initiate a study on historic employment trends in Newfoundland's forest industry. Prepare and carry out a survey of loggers in the logging industry in Newfoundland to better characterize the industry. Carry out studies to identify the market for Newfoundland sawmill and woodworking products and problems associated with marketing. Provide advisory services for an economic timber supply project to be carried out over 1986 to 1988. Provide services to acquire and modify benefit/cost model for silviculture activities. Prepare an updated mill timber demand analysis. Prepare an historical study of Newfoundland pulp and paper mill production and labour use. Develop a long-term economic research program of resource related problems using input from government and industry.

List of Studies

Short-term economic analyses.
Leader — D.L. Hayden
Forest resources economics research.
Leader — G.R. Milne
Forest industry economics research.
Leader — D.L. Hayden

Information and Technology Transfer Services

Project 2313
Information and Technology Transfer Services
Project Leader: D.R. Rex

Objectives: To conduct a forestry public relations program designed to improve awareness of ongoing research and to increase comprehension of research activities among client agencies; to provide advice to public and to non-government organizations on concerns specific to forestry and related forestry matters; to provide technical advice to researchers and research managers on all aspects of production of technical and non-technical information publications; to maintain an effective media relations program.

Achievements Current Year: Approximately 3 000 requests from the general public were actioned during this reporting period. Displays were set up in a number of schools in the St. John's area, the mall in Grand Falls during National Forestry Week and in both National Parks. Advisory services were provided to various youth organizations and members of the general public on subjects specific to ornamental forestry. Five information reports and four editions of "Woody Points" received editorial support. Support to the Newfoundland Forest Protection Association, Canadian Institute of Forestry, Federal Economic Development Coordinator and Forestry Subsidiary Agreement II communications committees were continued on a regular basis. CFS handout materials were distributed in bulk to unit offices of the Department of Forest Resources and Lands. Information activities specific to FSA II were continued with a number of joint press releases being prepared and editorial service provided on three brochures. Radio interviews were conducted as well as background information specific to forest protection and forest development prepared for the print media. Mailing lists were reviewed and updated as required. Work began on a communications plan for a new Canada-Newfoundland Forestry Subsidiary Agreement. Media training and video production workshops were organized and conducted for staff members. The inventory of audio visual equipment and supplies was increased and the Centre's photographic darkroom facility improved.

Goals for 1986-87: Activities will continue to expand because of additional emphasis and responsibility being placed on information services by NeFC management and CFS headquarters. Liaison activities with client agencies and specific public groups will increase. "Woody Points" newsletter will continue to be prepared on a quarterly basis and information reports, press releases, background articles prepared as required. Support to CFS headquarters will be provided as requested. Committee work will continue and if operationally feasible, expanded to include support to other organizations. Displays will be further im-

proved and expanded and will be available to cooperating agencies. Technical assistance will be provided to all cooperating agencies and general public groups as requested.

List of Studies

Public Information/Media Relations.
Leader — D.R. Rex
Publication/Editorial Services
Leader — D.R. Rex
Extension Services
Leader — D.R. Rex

General Research Support Services

Project 2251
General Research and Technical Support
Project Leaders: A.B. Case and J. Hudak

Objectives: To provide an efficient and high quality support service to meet the needs of the NeFC research and development program.

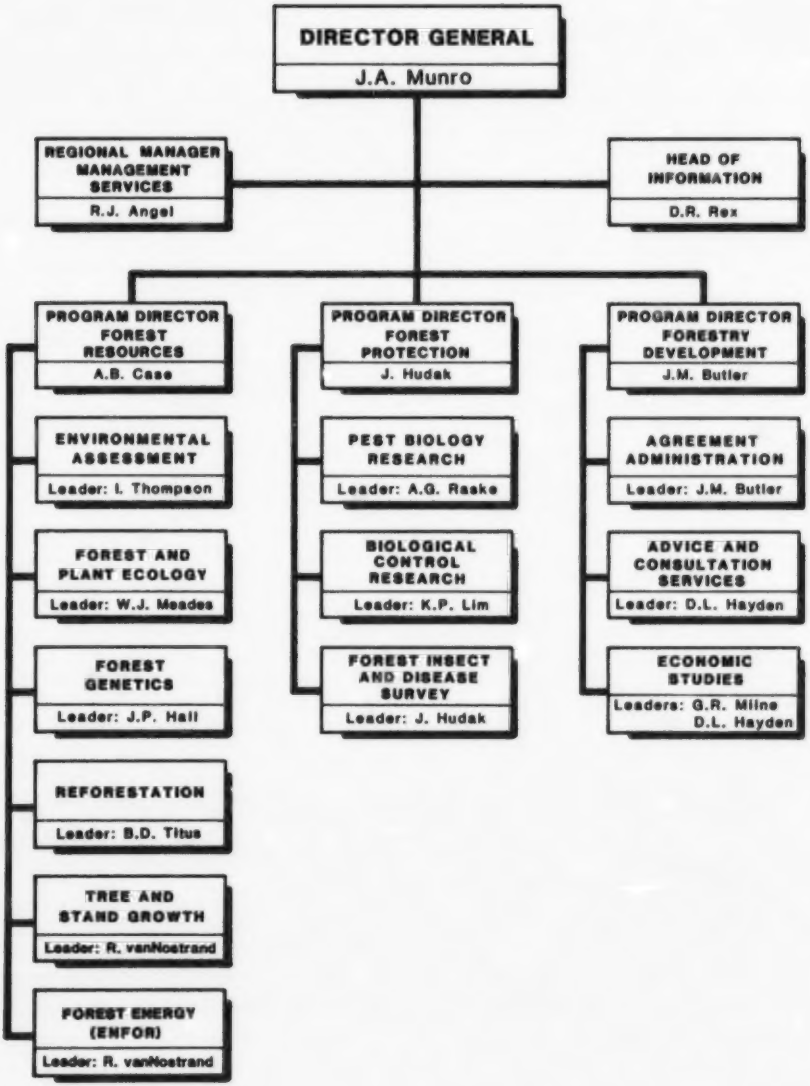
Achievements Current Year: *Nursery Service* — Maintained research plantings related to the *Salix* energy and the tree improvement projects. *Chemical and Physical Analysis Laboratory* — Provided soil and vegetation analysis services to in-house researchers; conducted water analysis in support of LRTAP for the Newfoundland Department of Environment and the Environmental Protection Service; conducted an evaluation of ion chromotography for sulfur analyses; implemented Gran-Titration method for water analysis. *Plant Herbarium* — Much of backlog of vascular specimens cleared up; approximately 1 000 specimens deposited in herbarium; a vascular checklist was prepared. *Greenhouse Facility* — Completed installation of overhead and sprinkler watering systems in all modules, expanded bench space; provided maintenance service for ongoing research experiments at the greenhouse. *Computer Services* — A request for a VAX 8200 was approved and placed on site. *Mycological Herbarium* — Many disease samples were identified and new additions made. The slide collection was improved. The whole herbarium was curated, updating all nomenclature and cataloguing all material. *Insect Reference Collection* — New additions were made to the native forest fauna of island insects collection. Special cataloguing enabling quick referencing to any species was completed. Many new seed and cone insects were added.

Goals for 1986-87: *Nursery Services* — To maintain research nursery transplants for *Salix* and *Larix* projects. Provide landscaping and transplant material for improvements to NeFC field stations. *Chemical and Physical Analyses Laboratory* — Continue the soil and vegetation analyses services to in-house researchers and water analyses to client agencies (Nfld. DOE and EPS). *Plant Herbarium* — To continue updating computerized accessions list; to publish vascular checklist and prepare non-vascular checklist; to improve the reference collection and expand the herbarium. *Greenhouse Facility* — To continue greenhouse services for on-going research. *Computer Services* — To replace the PDP 11/44 computer system with a VAX 8200 system and to train staff to use the new system. To increase research software available for the new system. To provide electronic data processing for staff and to advise on computing methods. *Mycological Herbarium* — To continue to enlarge and improve the herbarium and the slide collection of forest diseases of Newfoundland. *Insect Reference Collection* — To continue to improve and expand the regional insect reference collection.

List of Studies
Nursery Services.
Leader — C.H. Evans
Chemical and Physical Analyses Laboratory
Leaders — J.-G. Zakrevsky, E.M. Pike (Acting)
Plant Herbarium
Leader — S.M. Morgan
Greenhouse Facility
Leader — G.J. Mills
Computer Services
Leader — R.G. Hunter
Mycological Herbarium
Leader — G.C. Carew
Insect Reference Collection
Leader — K.E. Pardy

Appendices

NEWFOUNDLAND FORESTRY CENTRE
PROGRAM ORGANIZATION



STAFF LIST AND ORGANIZATION 1985-86

Director General - Dr. J.A. Munro
Secretary - E.E. Manuel

FOREST RESOURCES AND ENVIRONMENTAL RESEARCH
Program Director - A.B. Case

Chemical and Physical Analyses Laboratory ..... J.-G. Zakrevsky, E.M. Pike, E.R. LeBreton

Forest Ecology
- — Site/Succession ..... W.J. Meades, A.R. van Kesteren
- — Soils/Autecology ..... B.A. Roberts
- — Wetlands ..... E.D. Wells, S.M. Morgan
- — Impact Assessment ..... I. Thompson
- — Herbarium ..... S.M. Morgan

Growth and Yield
- — Ecophysiology/Stand Modelling . M.B. Lavigne
- — Stand Development ..... P. Newton, L. May
- — Mensuration/Biomass ..... R.S. van Nostrand, J.G. Donnelly
- — Biometeorology ..... A. Robertson, C.T. French

Forest Renewal
- — Tree improvement/genetics ..... J.P. Hall, W.J. Curran, P.T. Tricco
- — Site Preparation/ Stand establishment ..... B.D. Titus, V. Chaffey
- — Nursery Services ..... C.H. Evans
- — Greenhouse/Special Projects ... G.J. Mills

FOREST PROTECTION RESEARCH
Program Director - Dr. J. Hudak

Insect Populations ..... E.J. Dobesberger, J. Carter
Cone, Seed and Plantation Pests .... R.J. West, D.S. Durling
Bark Beetles ..... W.W. Bowers, J.W. Marshall
Damage and Impact ..... A.G. Raske, J.D. Rowe
Biological Control ..... K.P. Lim, L. Oldford
Mycology, Pathology ..... G.C. Carew
Wood Deterioration and Decay ..... G.R. Warren, J.P. Meades, A.L. Fudge
Computer and Statistical Analysis ... R.G. Hunter
Forest Insect and Disease Survey ... L.J. Clarke, K.E. Pardy, E.D. Banfield, D.S. O'Brien, W.J. Sutton, D.M. Stone

FORESTRY DEVELOPMENT BRANCH
A/Program Director - J.M. Butler

Senior Economist ..... G.R. Milne
Economist ..... D.M. Hayden
Senior Development Officer ..... Vacant
Forest Development Officer ..... W.L. Alexander
Forest Development Officer ..... L.R. West
Secretary ..... M.A. Grandy

INFORMATION AND TECHNOLOGY TRANSFER SERVICES

Head - D.R. Rex

Public Information	L.-A. Browne

MANAGEMENT SERVICES

Regional Manager - R.J. Angel

Finance	W.F. Walsh, E.C. Higdon, M.A. Martin, C.G. Prior
Purchasing	F.L. Bannister, J.J. Healey
Personnel	L. Mason
Library	C.E. Philpott
Central Registry	L.J. Fennelly
Office Services	M.F. Gillingham, E. Cooper, H. Dunphy
Field Station Facilities	W.V. Bonnell

NEWFOUNDLAND FORESTRY CENTRE
EXPENDITURES ($000) 1985-86

Program Areas	PY	Salaries	Development Agreement	CHALLENGE '85	ENFOR	O&M	Capital	Totals
Management	2.0	84.9				17.7		102.6
Administration	16.37	384.4				181.9	975.2	1,541.5
Forest Resources	25.51	950.8		44.7	194.1	278.6		1,468.2
Forest Protection	22.31	853.7		29.8		280.6		1,164.1
Forest Development	6.9	270.4	13,077.7	9.9		52.1		13,410.1
Technology Transfer/ Information Service	1.54	48.9		5.0		19.2		73.1
Total	74.63	2,593.1	13.077.7	89.4	194.1	830.1	975.2	17,759.6

RESEARCH PROJECT CONTRACTS 1985-86

Contractor	Title	Amount ($)
Memorial University 01k24-5-0024	Determination of Parasitic Nematodes in Forest Trees of Newfoundland & Labrador	$ 32,963.00
Northland Associates 01k24-5-0016	Calibration of the Forcyte Growth Model	52,974.00
Angelika West 01k24-5-0006	Survey of Insects Affecting Willow Biomass Production	16,602.07
Abitibi-Price 01k24-5-0005	Reforestation of Areas Harvested for Biomass.	10,000.00
Highlands Contracting 01k24-5-0004	Establishment & Maintenance of Experimental Plantations	55,000.00
Queens University 01k24-5-0003	Field Testing of Energy Balance Measuring Systems at Pasadena Forest Research Nursery	10,012.21
Barbara J. Dowsley 01k24-5-0002	A study of Correlation of Diurnal Growth Patterns to Climatic Variables in Salex Energy Plantations.	18,634.20
Patrick G. Dornan 01k24-5-0001	Maintenance of Biometeorological Research Station at Pasadena Forest Station	19,989.24
Memorial University KH205-4-0070	The Deposition and Mobilization of Storage Materials in Black Spruce in Nfld. and its relationship to Spruce Budworm Defoliation and subsequent attack by Armillaria Root Rot and Four-eyed spruce bark beetle.	41,388.10
Memorial University KH205-4-0066	Development of locally isolated parasitic nematodes for control of forest insect pests in Canada.	42,900.00

Publications

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